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Avian Model

Model Structure

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Model Preliminary Results

- Model developed using very few data, so not likely to be accurate at this stage
- However, should show the structure, and the results should follow selenium trends that are observed in natural systems.

Abiotic to Bird Model

- Avian model uses the results of the abiotic model to estimate selenium concentrations through the food chain to:
 - gull and shorebird diet, blood, liver, and eggs
 - grebe and goldeneye blood and liver

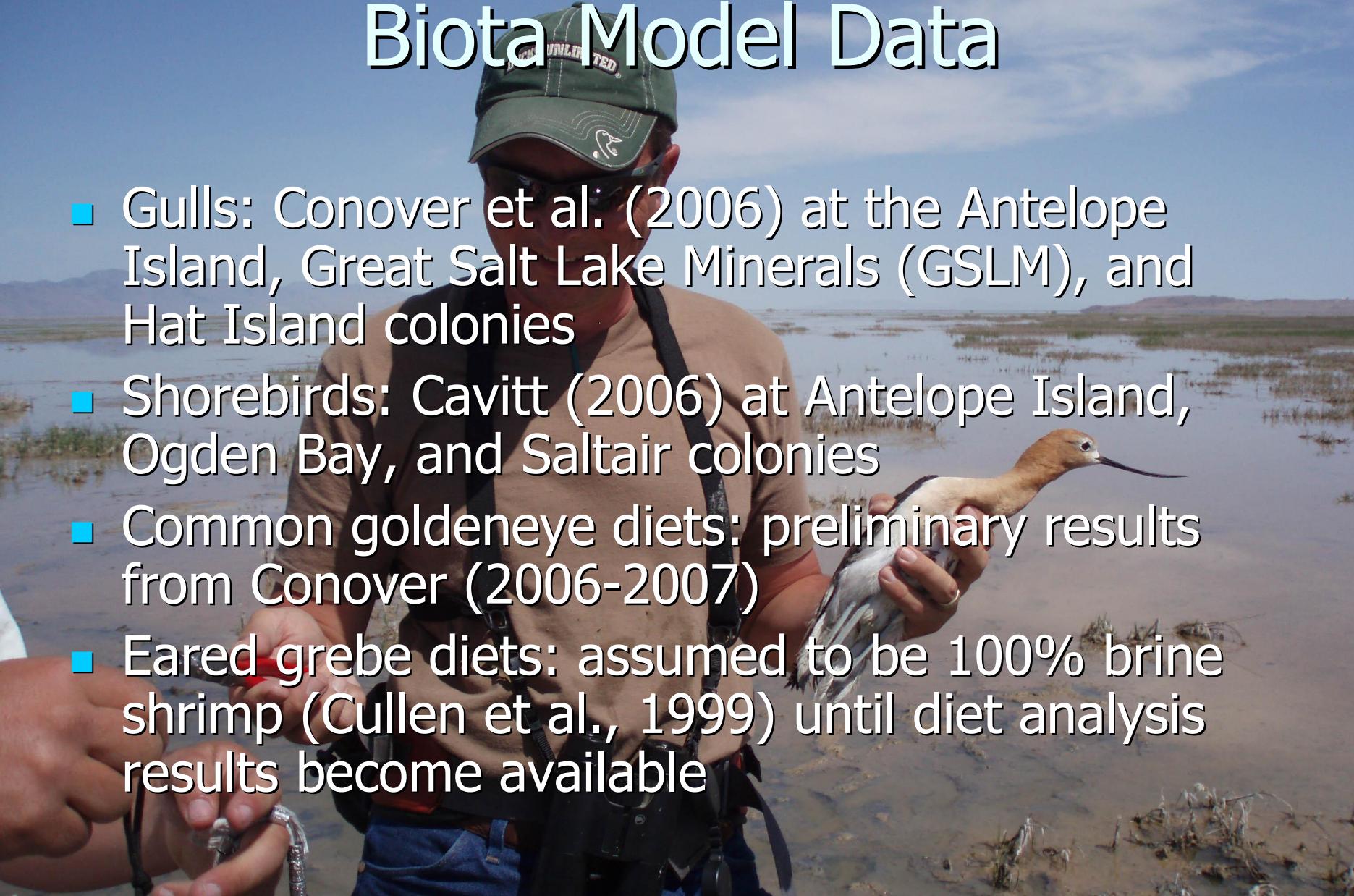
Diets

- Species-specific diet data were used to model selenium accumulation for each bird species:
 - eared grebe
 - common goldeneye
 - black-necked stilt
 - American avocet
 - California gull



Biota Model Data

- Gulls: Conover et al. (2006) at the Antelope Island, Great Salt Lake Minerals (GSLM), and Hat Island colonies
- Shorebirds: Cavitt (2006) at Antelope Island, Ogden Bay, and Saltair colonies
- Common goldeneye diets: preliminary results from Conover (2006-2007)
- Eared grebe diets: assumed to be 100% brine shrimp (Cullen et al., 1999) until diet analysis results become available



Weighting Factors

- Diets weighted based on the results of studies conducted during 2006 and 2007 in which food items were recovered from the digestive tracts of birds collected from the areas where water, sediment, invertebrates, and bird eggs were collected

California Gull Diets

1. 100% brine shrimp
2. 100% brine fly
3. 100% corixid
4. 60% brine shrimp, 35% corixid, and 5% midge larvae



American Avocet Diets

1. 100% brine fly
2. 66% midge, 20% brine fly, 14% corixid
3. **40% midge, 36% brine fly, 24% corixid**

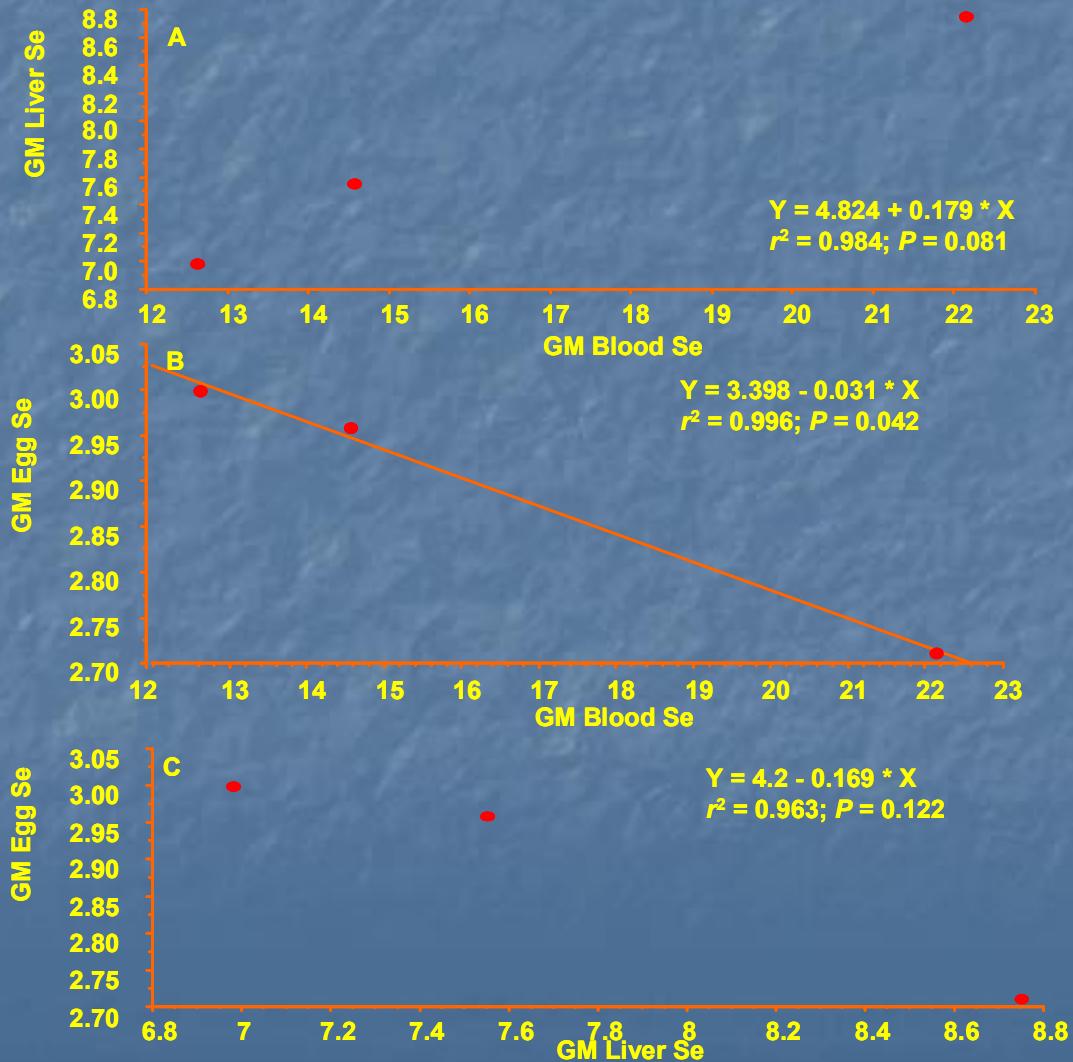
Common Goldeneye Diet

- 1% brine shrimp; 18% brine shrimp cysts; 39% brine fly (larvae); 18% corixid (freshwater invertebrates); 24% other (wetland plant seeds)

Eared Grebe Diet

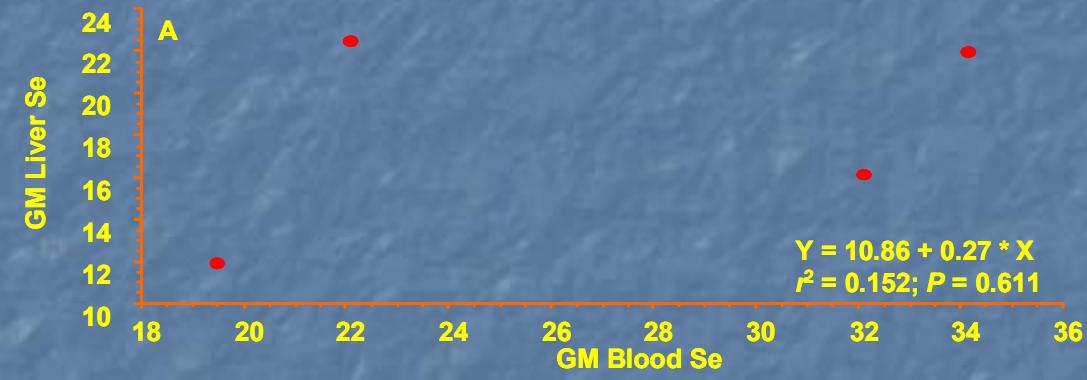
- 100% brine shrimp

Correlation of Colony Means of Blood to Liver (A), Blood to Egg (B), and Liver to Egg (C) Concentration ($\mu\text{g Se/g dw}$) in California Gulls



Correlation of Colony Means of Blood to Liver (A), Blood to Egg (B), and Liver to Egg (C)

Concentration ($\mu\text{g Se/g dw}$) in Shorebirds



Transfer Factor Equations

- Blood [Se] = (GM Blood [Se] / GM Diet [Se])
- Liver [Se] = (GM Liver [Se] / GM Diet [Se])
- Egg [Se] = (GM Egg [Se] / GM Diet [Se])

Estimated Transfer Factors

Transfer Factors from Bird Diet to Bird Blood, Liver, and Eggs and Modeled Versus Average 2006 Measured Values. Preliminary example values, only.			
Bird tissue and egg	Transfer Factor Formula	Transfer Factor	Modeled Future Values ($\mu\text{g Se/g dw}$)
Blood:			
Gull	BloodSe/Diet Se 18/3.1	5.7	17.5
Shorebird	26/1.99	13.2	30
Grebe	No data available / 3.68	ND	ND
Goldeneye	No data available / 1.23	ND	ND
Liver:			
Gull	LiverSe/Diet Se 8.1/3.1	2.5	8.0
Shorebird	17.5/1.99	8.8	20
Grebe	No data available/3.68	ND	ND
Goldeneye	No data available/1.23	ND	ND
Egg:			
Gull	EggSe/Diet Se 3.1/3.1	1.0	3.1
Shorebird	2.4/2.27	1.2	2.7

Preliminary Results: Avian Model Demonstration

StrawBird V2.1 GSL Model						
PROPORTION IN DIET INPUT						
FOOD ITEM	From Abiotic Se (mg/kg)	GULL	Shorebird	Grebe	Duck	
		Diet Fraction*	Diet Fraction*	Diet Fraction*	Diet Fraction*	
Brine shrimp	1.0	0.60	0.00	1.00	0.01	
Brine shrimp cysts	1.3	0.00	0.00	0.00	0.18	
Brine fly	2.1	0.00	0.36	0.00	0.39	
Corixid	2.7	0.35	0.24	0.00	0.18	
Midge	2.3	0.05	0.40	0.00	0.00	
Other		0.00	0.00	0.00	0.24	
Total		1.00	1.00	1.00	1.00	
Offsite	1.9	0.10	0.10	0.10	0.10	Assumed Se concentraton for offsite = 1.9 mg Se/kg
Onsite		0.90	0.90	0.90	0.90	
Total		1.00	1.00	1.00	1.00	

Project 1 Values			
SOURCE INPUT			
GSL 2006		Water*	Sediment*
Lakewide		0.585	0.5

*Numbers in blue can be changed.



GULL OUTPUT			
Gull diet [Se]	Gull Blood [Se]	Gull Liver [Se]	Gull Egg [Se]
1.6	9.1	4.1	1.6
SHOREBIRD OUTPUT			
Shorebird diet [Se]	Shorebird Blood [Se]	Shorebird Liver [Se]	Shorebird Egg [Se]
2.3	29.7	19.7	2.7
EARED GREBE OUTPUT			
Grebe diet [Se]	Grebe Blood [Se]	Grebe Liver [Se]	
1.2	#NUM!	#NUM!	
GOLDFENEYE OUTPUT			
Goldeneye diet [Se]	Goldeneye Blood [Se]	Goldeneye Liver [Se]	
1.6	#NUM!	#NUM!	

Preliminary Results: Shorebird Diets Model Demonstration

ShoreBird V3.0 GSL Model					
		PROPORTION IN DIET INPUT			
FOOD ITEM	From Abiotic Se (mg/kg)	Diet Fraction*	Diet Fraction*	Diet Fraction*	Lakewide
Brine shrimp	1.0	0.00	0.00	0.00	0.00
Brine shrimp cysts	1.3	0.00	0.00	0.00	0.00
Brine fly	2.1	1.00	0.20	0.36	0.00
Corixid	2.7	0.00	0.14	0.24	1.00
Midge	2.3	0.00	0.66	0.40	0.00
Sediment	0.5	0.05	0.05	0.05	0.05
Total		1.05	1.05	1.05	1.05
Offsite	1.9	0.10	0.10	0.10	0.10
Onsite		0.90	0.90	0.90	0.90
Total		1.00	1.00	1.00	1.00

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Assumed Se concentration for offsite = 1.9 mg Se/kg

Project 1 Values				SHOREBIRD OUTPUT			
SOURCE INPUT				Shorebird diet [Se]	Shorebird Blood [Se]	Shorebird Liver [Se]	Shorebird Egg [Se]
GSL 2006		Water*	Sediment*	2.1	30.9	20.5	2.8
Lakewide		0.585	0.5	2.2	29.6	19.7	2.7

*Numbers in blue can be changed.

SHOREBIRD OUTPUT			
Shorebird diet [Se]	Shorebird Blood [Se]	Shorebird Liver [Se]	Shorebird Egg [Se]
2.3	29.7	19.7	2.7

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